# WATER QUALITY

## **Beneficial Use Attainment (MDNR 1984)**

The major fisheries resource problem is loss of habitat due to siltation and channelization. Soil erosion causes chronic violations of the secondary drinking water supply standards for iron and manganese. There are also localized problems with low dissolved oxygen concentrations below sewage treatment plants during low flow conditions.

Although whole-body contact recreation is a designated use of the Grand River, conditions are marginal because of poor access, steep mud banks, soft mud bottoms and violations of the fecal coliform standard during runoff periods.

Many streams within the Grand River Basin were naturally turbid under pristine conditions (MDNR 1986b). Most will probably not be brought into compliance with water quality standards for turbidity even with strict erosion control programs (MDNR 1986b).

## **Chemical Quality of Stream Flow**

The principal water quality problems in north Missouri streams are suspended sediment, elevated water temperatures, acidic waters, pesticide spills and the loss of pool habitat (USDA-SCS 1982). USGS water quality data indicates that water in Grand River is often turbid. Water quality standards are commonly exceeded for bacteria, manganese and iron (Table 6). From 1984-1986 there were increasing amounts of nitrogen in various forms entering Grand River (MDNR 1986b). This was attributed to increased runoff of nitrogen fertilizer and possibly increased runoff of animal wastes (MDNR 1986b).

Detailed water quality surveys have been conducted for Big Creek in Daviess and Harrison counties (Kangas and Crawford 1977), Grindstone, Lost, and Muddy creeks (Rowe 1979) and Big and Hurricane creeks in Carroll County (Mid-Missouri Engineers 1980).

Conclusions of the various investigators were that these streams had moderate nutrient enrichment. Both pollution tolerant and intolerant species of invertebrates were present at the various sites. Bacteria levels indicated that much of the enrichment in these streams was from livestock runoff. Habitat loss seemed to be more of a limiting factor to fish and invertebrates than the chemical quality of the water.

## Fish Contamination Levels, Health Advisories, and Chronic Fish Kill Areas

Due to elevated chlordane levels the Missouri Department of Health currently recommends not eating more than one pound of catfish, carp, buffalo, drum, sucker and paddlefish per week from anywhere in Missouri outside the Ozarks (Table 7). This consumption advisory applies to the entire Missouri portion of the Grand River Basin. This advisory will probably be lifted within the next 10 years as chlordane levels decline (A. Buchanan, MDC, personal communication).

Contaminant samples were collected in Brookfield City Lake, Cameron City Reservoir #2, Cameron City Reservoir #3, Jamesport Community Lake, Lake Paho, Limpp Lake, Pony Express Lake and Worth County Community Lake. Contaminant levels were below threshold levels in all lakes sampled in the Missouri portion of the basin.

Fish kills throughout the basin have been scattered. Many have been associated with sedimentation of farm ponds, improper management of wastewater holding facilities and chemical spills. Undoubtedly, many undocumented fish kills occur within the basin. Fish kills due to increased use of agricultural chemicals have been suggested as one reason for the decline of the Topeka shiner (*Notropis topeka*) within the basin (Pflieger, MDC, personal communication). Large fishkills have occurred recently as large corporate farms have become established in the watershed.

Four companies (Williams, Amoco, Mapco, and Arco) have a network of oil pipelines within the basin. These pipelines were buried under channelized streams. Downcutting and meander formation have exposed pipelines at various locations creating the potential for major oil spills. Recent efforts to protect these pipelines have reduced the threat.

#### **Water Use**

- a. **Municipal** In Missouri, there are 28 surface water withdrawals from the Grand River Basin. Most municipal water comes from city reservoirs located on tributary streams. Chillicothe, Ridgeway, Trenton and Brookfield withdraw water from Grand River, Big Creek, Thompson River and Yellow Creek, respectively.
- b. **Agricultural** Minimal irrigation takes place within Missouri's portion of the basin and is limited mainly to three counties (Livingston, Carroll and Grundy). Less than one thousand acres are irrigated annually in any of these counties (MDNR 1986a).
- c. **Wetland areas** MDC's Fountain Grove CA pumps approximately 4,000 acre-feet of water from the lower Grand River during late summer and early fall. Several private waterfowl hunting clubs in the lower portion of the basin also pump water from Grand River when conditions necessitate.

Currently, water withdrawal from streams within the Grand River Basin is probably not a widespread problem. Water quantity may become more of an issue in the future as large corporate farms expand operations in the basin.

#### **Point Source Pollution**

Figure ps highlights the point source discharges throughout the basin. Most of the discharges are small and scattered with limited impact on any particular reach. An exception to this is East Fork of Big Creek in Harrison County, Missouri. There have been chronic violations of water quality standards in East Fork of Big Creek below the City of Lamoni, Iowa and Bethany, Missouri.

The wastewater treatment plant at Milan has experienced numerous algae blooms that have escaped

into receiving streams. The green water has caused concerns to adjacent landowners. In 1990, the City of Cameron was issued a series of citations for releases of poorly treated water into Brushy Creek. No recent violations have been reported.

### **Non-Point Source Pollution**

Water quality within the basin is most affected by non-point water pollution sources (MDNR 1984, Figure ca). Soil erosion and the runoff of animal waste are the principal sources of concern. Sheet and rill erosion is excessive on tilled land throughout the basin. Erosion rates vary from 13 to 24 tons/acre/year. On permanent pasture lands, soil loss is at "tolerable" levels (2-5 tons/acre/year). Gully erosion varies from moderate (100-199 tons/mi²/year) in the lower Grand River Basin and Thompson River Basin to very severe (500-750 tons/mi²/year) in the upper reaches of the watershed (Anderson 1980).

It is estimated that 9.5 million PE (human population equivalent) of cattle and hogs existed in the basin in the mid 1980's (MDNR 1984). Animal waste causes problems with low oxygen and toxicity problems in streams both during runoff and low flow periods. The corporate hog industry has designated the Grand River Basin as a favorable site for large scale hog production. Premium Standard Farms and Continental Grain have brought more than 4 million PE into five counties (Daviess, Grundy, Mercer, Putnum and Sullivan counties).

Table 6. Selected water-quality data for the Grand River near Sumner at gage station 06902000, water years 1988 and 1992 (USGS 1988; USGS 1992, MDNR 1992, Code of State Regulations 10 CSR 20.7).

	State Standard				Water Year	
Parameter	I	III	VI	VII	1988	1992
Temperature (°F)	90° max				32-86	32-77.9
Specific Conductance (ys/cm)					220-540	318-510
Ph					7.4-8.1	7.8-8.2
Turbidity (NTU)						16-140
Sediment, suspended (mg/L)					39-2930	75-384
Oxygen, dissolved (mg/L)	5				6.4-13.9	7.3-13.7

Table 6 continued

Parameter	I	III	VI	VII	1988	1992
Coliform, fecal				200-storm runoff	K60- 12,000	K16- K70,000
Streptococci, fecal (colonies/100ml)					K25- 95,000	K52- K83,000
Total Hardness (mg/L CaCO <sub>3</sub> )					110-260	140-250
Nitrogen, Total Ammonia (mg/L as N)	Depends on temp & Ph				<0.010- 0.340	0.030- 0.100
Phosphorus, Total (mg/L as P)					0.070- 0.250	0.110- 0.340
Manganese, dissolved (yg/L as Mn)		50		50	34-370	8-61
Iron, dissolved (mg/L as F <sub>e</sub> )	1,000	300		300	12-400	7-130

K: Non-ideal count of colonies (e.g., sample was not diluted enough, colonies merged)

I: Protection of aquatic life

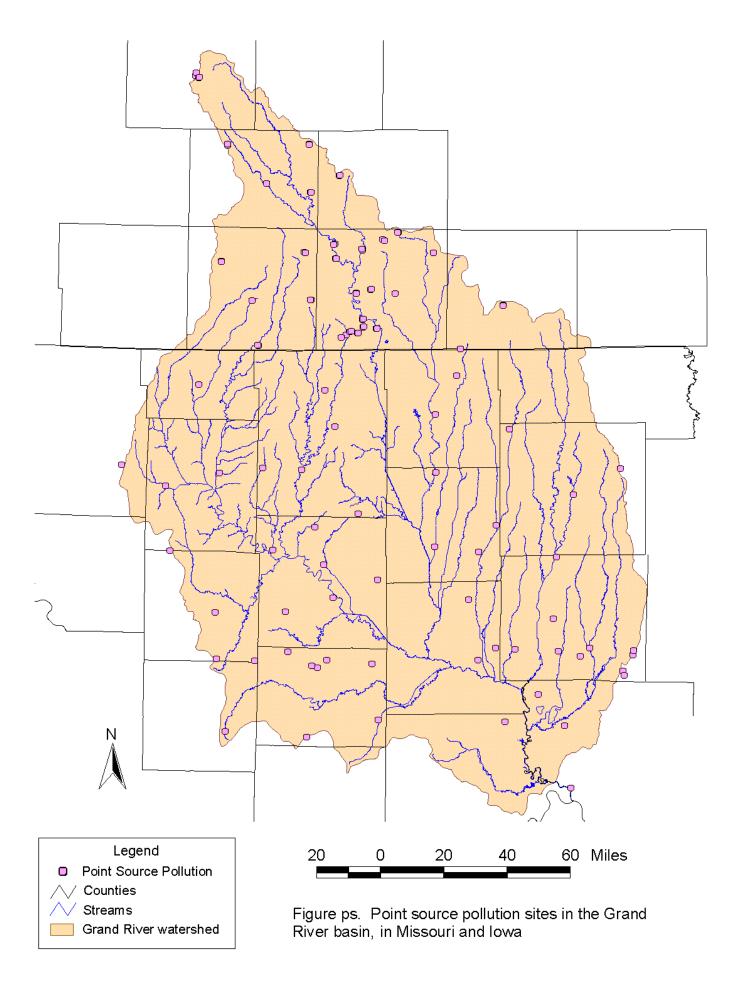
III: Drinking water supply

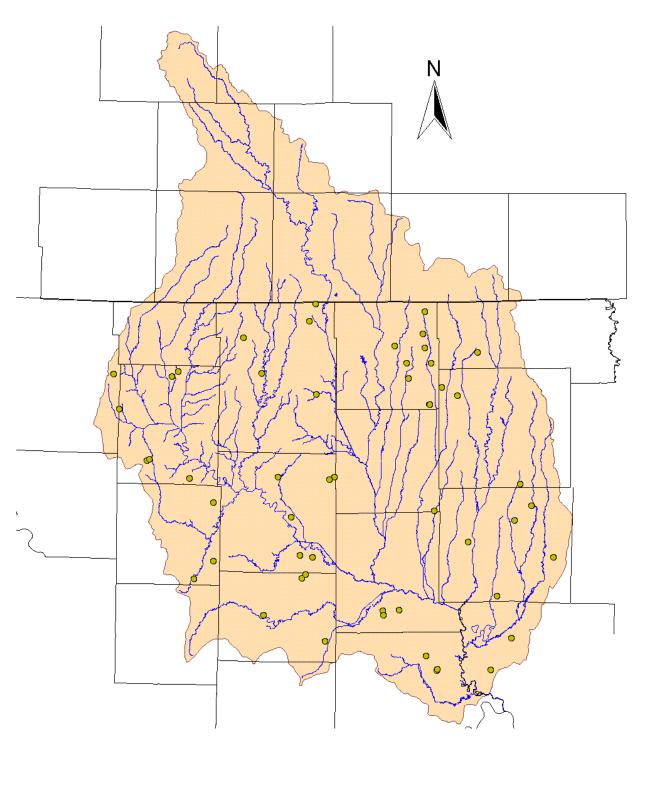
VI: Whole-body-contact recreation

VII: Groundwater

Table 7. Contaminants in fish in Grand River (ppb).

Year	Water	Species	Chlordane	Mercury			
1990	Grand River/Gentryville	Carp Channel Catfish	165 57	56 88			
1998	Grand River/Gallatin	Carp Flathead catfish	60	220			
Level of concern for chlordane = 300 ppb; for mercury = 1,000 ppb. Fish fillet composites.							





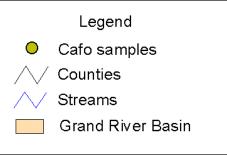




Figure ca. Cafo locations in the Grand River Watershed in Missouri